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RESULTS OF HERBICIDE TRIALS TO CONTROL JAPANESE HONEYSUCKLE

Abstract. Three or more annual sprays are required to eliminate Japanese honeysuckle where 2,4-D, a mixture of 2,4-D and 2,4,5-T, or amitrole is applied as either a low-volume (mistblower) or high-volume spray. Dicamba and picloram are more effective. The mixture of 2,4-D and picloram is recommended as the best material for eliminating honeysuckle in a single treatment at the time of harvesting overstory trees. However, 3 gallons of the material, costing about $33, are required per acre.

THE CONTROL of Japanese honeysuckle *(Lonicera japonica)* is important for managing many woodlands of eastern Maryland, Delaware, southern New Jersey, and southeastern Pennsylvania. This vine not only forms a dense cover on the ground, but it may also climb and overgrow shrubs, saplings, and small pole trees so that they are deformed and even killed by smothering. When Japanese honeysuckle is present in openings, its growth is particularly luxuriant and usually prevents reproduction of other vegetation. Foresters often hesitate to harvest trees on sites where honeysuckle occurs for fear that they will be unable to establish a new forest stand.

Although found in some pine stands, honeysuckle is most troublesome on the best hardwood sites—those that should grow high-grade yellow-poplar, oak, and sweetgum. In Maryland this pest was found on 8 percent of the sites in the upper Coastal Plain and Piedmont *(2)*, and it probably occupies similar proportions of the woodlands in northern Delaware, southeastern Pennsylvania, and the inner Coastal Plain of New Jersey.

In 1957, in cooperation with the Maryland and New Jersey forestry departments, the City of Baltimore, and five chemical companies, the

Northeastern Forest Experiment Station of the U. S. Forest Service began testing several herbicides for controlling honeysuckle. Progress reports on these trials were published in 1959 and 1961 *(8, 9)*. This report summarizes the results to date, with major emphasis on the findings since 1961.

Study Methods

The first trials were confined to three materials recommended for controlling honeysuckle in the Southeast. These were 2,4-D (2,4-dichlorophenoxyacetic acid), recommended by Walker *(10)*; and two materials originally recommended by the Southeastern Forest Experiment Station *(1, 5)*—a 2:1 mixture of the butoxy ethanol esters of 2,4-D and 2,4,5-T (2,4,5-trichlorophenoxyacetic acid), and amitrole (3-amino-1,2,4-triazole). The last was first available as a water-soluble powder and later as a liquid formulation (Amitrol-T) that also contained ammonium thiocyanate. More recently, all these materials have again been recommended for use on honeysuckle in the Southeast *(3, 4, 7)*.

Because none of the above materials was effective in our trials as a single treatment, several others that offered promise were tried in 1959 or in subsequent years. During this period, too, increasing use was made of mistblower applications in place of high-volume sprays.

In all, 187 plots were established. Where treatments involved the use of pellets or high-volume sprays, each plot was 1/40 acre or 33 feet square. Where mistblower treatments were made, each plot was 1/10 acre. During the first 3 years of the study, plots were scattered among the Green Bank and Belleplain State Forests in New Jersey and four different properties in the Havre de Grace-Annapolis section of Maryland. All the plots established between 1960 and 1964 were on one property near Towson in Baltimore County, Maryland.

Descriptions of the earlier treatments and their results can be found in the 1959 and 1961 reports *(8, 9)*. The effects of burning and grazing, of honeysuckle density, of the timing of treatments, and of the type and amount of herbicide carrier also are discussed in the first report; and most of the chemical formulations that have been ineffective in our trials are listed and commented upon in the second report. That material will not be repeated here. The following discussion of results is confined to the more effective formulations.

All spray rates given in this paper are on an acre basis. In the initial treatment on each plot the full amount of spray per acre was applied. Amounts used in subsequent treatments were sufficient to wet thoroughly all living honeysuckle foliage seen by the operator.

Results

Five herbicidal materials, essentially the first three tested in 1957 and two newer ones, have shown the most promise of controlling Japanese honeysuckle. The three from 1957 are amitrole, a mixture of 2,4-D and 2,4,5-T, and 2,4-D alone; the two newer ones are dicamba (the dimethylamine of 3,6-dichloro-*o*-anisic acid[1]) and picloram or picolinic acid (4-amino-3,5,6-trichloropicolinic acid)[2].

Amitrole.—Trials with amitrole have included formulations both as liquid (Amitrol-T) and as a water-soluble powder. June or July treatments with this chemical have varied greatly in effectiveness as table 1 shows. In this listing all except the last treatment were high-volume sprays; the last was made with a back-pack mistblower.

As the table indicates, similar treatments repeated up to four or five times may almost eliminate the honeysuckle cover or may cause little or no reduction. Because of this variability, we do not recommend amitrole for general use in honeysuckle control.

[1]Formerly called 2-methoxy-3,6-dichlorobenzoic acid.

[2]Trade names are Banvel D and Tordon, respectively. Mention of trade names should not be construed as an endorsement of a particular commercial product by the Forest Service or the U. S. Department of Agriculture.

Table 1.—*Trials with Amitrole*

Spray mixture: active ingredient in pounds, water in gallons	Number of annual treatments	Reduction of honeysuckle by plots
5 pounds in 125 gallons	5	Complete elimination .....1 plot Reduction to about 6 clumps....2 plots
5 pounds in 125 gallons	4	Reduction to 8 — 10 clumps...3 plots No reduction .....1 plot
5 pounds in 250 gallons	5	Reduction to light cover down to scattered clumps .....all plots
5 pounds in 250 gallons	4	Almost complete elimination....2 plots Reduction to light cover.....2 plots
4 pounds in 100 gallons	3	Reduction to light cover down to 9 or 10 clumps.....all plots
8 pounds in 100 gallons	3	Reduction to 3 — 5 clumps.....2 plots Reduction to about 10 clumps...1 plot Reduction to light to medium cover .....1 plot
8 pounds +1 gallon +4 teaspoons of Triton B-1956 spreader-sticker (mistblower)	2	Reduction to light cover.....all plots

2,4-D and 2,4,5-T mixture.—The combination of 2,4-D and 2,4,5-T has been appreciably more effective and consistent than amitrole. In all plots that received five or six treatments with this mixture, the old growth of honeysuckle was eliminated. In eight plots that received three or four treatments, the honeysuckle was eliminated in four plots and reduced to one to three clumps in the others. Although the 1961 paper *(9)* stated that 8 pounds acid equivalent of the chemicals in 125 gallons of water was slightly more effective than the same amount in 250 gallons, little difference was evident in our more recent results.

Mistblower applications of the mixture of 2,4-D and 2,4,5-T were tried in early December and in July or August at two rates: 4 pounds of active ingredient in 4 gallons of water, and 8 pounds in 4 gallons. In these treatments the 8-pound rate was slightly more effective than the 4-pound one, but not enough to warrant the extra cost. The December treatments, although fairly effective, produced somewhat less foliage kill and stand reduction than the summer applications. Two treatments in July or August, a year apart, almost eliminated heavy stands of honeysuckle; however, occasional runners usually survived.

2,4-D.—Results from using 2,4-D alone have been similar to those from the mixture with 2,4,5-T. Again, in all plots receiving five or six treatments, the old-growth honeysuckle was eliminated. In the eight plots that got three or four treatments of 8 pounds acid equivalent of 2,4-D in 125 or 250 gallons of water, honeysuckle was eliminated in three plots and was reduced to one to four sprout clumps per plot in the others. Although in the earlier report *(9)* 250-gallon treatments with butoxy ethanol, ethyl, or isopropyl esters of 2,4-D were said to be slightly better than 125-gallon treatments, this difference was not borne out in the later results.

Three newer formulations of 2,4-D and related compounds also were tried in high-volume sprays. These were the 2,4-D emulsifiable acid,[3] 2,4-DB [4-(2,4-dichlorophenoxy) butyric acid], and dichlorprop or 2,4-DP [2-(2,4-dichlorophenoxy) propionic acid], all used at 4- and 8-pound acid equivalent rates in 100 gallons of water. Three annual treatments of 2,4-DB or 2,4-DP failed to eliminate the old growth of honeysuckle; each plot still contained four to seven sprout clumps. The 2,4-D emulsifiable acid was somewhat more effective, but after three treatments it had completely eliminated the honeysuckle on only one plot; two or three clumps still survived on each of three other plots.

In mistblower applications the isopropyl ester, butyl ester, and emulsifiable acid of 2,4-D produced somewhat variable results. Spray mixtures

[3]Trade name is Weedone 638.

contained 4 or 8 pounds of the active ingredient in water; total volumes were 5 or 6 gallons; and applications were made on some plots in July or August and on others in early December. The emulsifiable acid was also tried in five other concentrations: 4 pounds in a total volume of 2.65 gallons, 8 pounds with no additional carrier, 8 pounds in volumes of 4.2 and 5.6 gallons, and 12 pounds in a volume of 6 gallons. The emulsifiable acid was at times more effective than the older esters, but not consistently.

All chemicals and concentrations were generally more effective in summer treatments than in early December treatments, but, again, not consistently more effective. In one December treatment of 8 pounds acid equivalent of the butyl ester in 6 gallons of spray, the initial top-kill approached 100 percent, but other December treatments were not similarly effective. An application of 8 pounds of the emulsifiable acid in 5.6 gallons of spray in July 1961 eliminated an exceptionally high proportion of the honeysuckle, but re-treatment a year later failed to eliminate the scattered sprouts. And similar treatments in other summers were not nearly as effective as the 1961 application.

Thus, even though two treatments almost eliminated honeysuckle in some plots, the results were so variable that not one of these 2,4-D formulations can be recommended as effective in eliminating honeysuckle in less than three annual treatments.

Dicamba.—Dicamba was tried only in mistblower treatments and in the July-August period, at two rates: 4 and 8 pounds of active ingredient in water, with spray volumes of 5 and 6 gallons respectively. The initial treatments were extremely effective, eliminating more of the honeysuckle cover than any of the 2,4-D treatments; but re-treatments a year later failed to eliminate the scattered regrowth. Results with the two rates were about the same.

The failure of second treatments to eliminate the scattered regrowth may have been due to the protection provided by a dense, tall cover of herbaceous weeds that developed between treatments. These weeds, mostly wild lettuce, were 6 to 8 feet tall and only about a foot apart when the re-treatments were made.

Picloram.—In 1963 and 1964, three formulations of picloram were tried: Tordon 101 Mixture, which contained 0.54 pound of picolinic acid and 2 pounds of 2,4-D acid per gallon as the triisopropanolamine salts; Tordon 22K, which contained 2 pounds of picolinic acid per gallon as the potassium salt; and Tordon 10K, a pelleted formulation containing 10 percent of picolinic acid as the potassium salt in an inert carrier.

The pellets were relatively ineffective in our trials. Two August treatments, each using 80 pounds of Tordon 10K (8 pounds active) and made a year apart, still left a light cover of honeysuckle.

If enough of the formulation was used, Tordon 101 and Tordon 22K proved effective both years in single August treatments. With Tordon 101, one application of 3 or 5 gallons per acre in water, 250 gallons total volume, completely eliminated the honeysuckle on most of the test plots. But 1 gallon per acre in the same volume did not provide complete control, even after two August treatments a year apart. Tordon 22K, used only at 2½ gallons per acre (same total volume), also eliminated honeysuckle in one treatment.

Plots where honeysuckle had been eliminated by picloram remained conspicuously devoid of vegetation during the following year, and thus were in marked contrast to the dicamba-treated plots with their rampant weed growth. However, in 1965 scattered plants and patches of pokeberry and wild lettuce developed in the picloram plots that had been sprayed in 1963. So, presumably, natural tree reproduction might start or seedlings might be planted the second spring after a picloram treatment with little risk of mortality from residual herbicide.

The residual effect of picolinic acid in the Baltimore area seemed to last much longer than the residual effect Brender and Moyer *(6)* observed in Georgia. Six months after spraying picloram at rates up to 3¾ pounds acid equivalent per acre, they planted loblolly pine seedlings and noted no residual effect of the chemical on pine survival. However, reports from the manufacturer, Dow Chemical Company, state that decomposition and leaching of this herbicide are greatly affected by climatic conditions, so the apparent difference between Maryland and Georgia is perhaps to be expected.

Discussion

Japanese honeysuckle is a tenacious weed: once established, it is exceedingly difficult to eradicate. Grazing, burning, repeated cutting, and various herbicides will reduce it, but usually only temporarily. Some root crowns survive all but the most intensive eradication measures and soon re-establish a full cover by rapid regrowth of sprouts. In one block of plots of this study, the average 1-year growth of marked sprout runners, including laterals and sublaterals, was about 25 feet. In most plots where kill was mainly confined to the tops, two growing seasons were sufficient for the vines to regain their original density.

On the other hand, reinvasion by seedlings is relatively slow. The many

honeysuckle seedlings reported in 1961 *(9)* later proved to be Tartarian honeysuckle *(L. tatarica);* usually no more than one or two seedlings of Japanese honeysuckle had started per 1/40-acre plot. The growth of the seedlings was slow at first, but by the third or fourth year they had developed four to seven runners 4 to 8 feet long. It appears that seedlings of Japanese honeysuckle will not be a serious problem if reproduction of tree species is promptly established after the original vines have been killed.

Some authors believe that honeysuckle infestations need not always be eliminated before tree seedlings are planted. Bruner and Shearin *(7)* report that in South Carolina successful plantations of loblolly pine can be established by planting in furrows where the vines are less than knee deep. However, where the honeysuckle is more rampant and drapes over shrubs and trees, they recommend two sprays of 2,4-D or amitrole before planting.

In our section more control of honeysuckle than Bruner and Shearin advocate seems advisable. Mechanical methods of control are not generally feasible. Herbicides seem to offer the best solution. The ideal herbicidal treatment would be one that would eradicate the honeysuckle in a single treatment, and that could be used just before regenerating a timber stand —that is, a treatment without adverse residual effects.

Because the older herbicidal materials have to be applied in three or more successive annual sprays to eliminate honeysuckle, the two newer materials, dicamba and picloram, appear most promising. This is true despite the demonstrated residual effects of picloram and the likelihood that both dicamba and picloram may damage established trees if sprayed on honeysuckle growing under them. Therefore, spraying with either of these chemicals should be done in forest stands only as a conditioning treatment at the time the stands are harvested.

Dicamba was not as effective as picloram in our trials, and re-treatment often would be required. If the re-treatment were delayed until the second spring when herbaceous plants were small and not effective in screening honeysuckle regrowth, the period before tree reproduction could be established would be longer than for picloram. Furthermore, dicamba at the 4-pound rate and with a re-treatment would be more expensive at present prices than a single application of the Tordon 101 Mixture.

Therefore, Tordon 101 is suggested as the best material to use where its residual effects can be accepted. Although Tordon 22K was also effective, the 101 mixture is much cheaper for what seem to be reasonable rates of application. On the basis of our tests the Tordon 101 Mixture should

be used at the rate of 3 gallons per acre. Although we applied it only as high-volume sprays, mistblower application of this amount in 3 gallons of water would seem to be a possible alternative where such a treatment could be safely used. Even so, it will be expensive, costing about $33 per acre for material alone.

For releasing desirable reproduction from honeysuckle, two of the older materials warrant further trials. If the reproduction were hardwoods, 2,4-D applied in the fall (October to early December) might provide temporary release with little damage to the trees. If the reproduction were conifers, Bruner and Shearin's suggested use of amitrole might be tried. Because neither of the above treatments has been tested locally for these specific purposes, they should be regarded only as suggestions for trial in our area.

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